# Structural change in the Brazilian economy

# 1959-80

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**Resumo:** O presente artigo analisa as principais fontes de *mudança estrutural* na economia brasileira entre 1959 e 1980. Utilizando as matrizes de insumo produto do Brasil e o modelo de Decomposição, desenvolvido por OECD (1992), as variações no produto são decompostas do ponto de vista da demanda em cinco componentes: variações na demanda final doméstica, variações nas exportações, variações na substituição de importações de produtos finais, variações na substituição de importações de produtos intermediarios, e variações nos coeficientes técnicos. As principais variaveis envolvidas no processo de mudança estrutural e na direção tomada por este processo no caso brasileiro são discutidas neste artigo.

# 1 Introduction

This paper uses a decomposition technique in order to examine the main sources of structural change of the output in the Brazilian economy from late 1950s to the 1980s. The change growth is decomposed into changes due to the five demand components: domestic final demand, exports, imports of final products, imports of intermediate inputs, and input-output coefficients.

This technique can help to analyse at least three central questions related to the process of structural change in the Brazilian economy:

a) What were the main engines of change of the Brazilian economy in the period 1959 to 1980?

b) Where were the importance of the domestic final demand and exports for growth in the same period?

c) What were the main direction taken by the industry in this process?

The paper is divided into five sections. After this introduction the second section describes the basic mathematical decomposition model used in this article. The third section analyses the main sources of structural change of the Brazilian economy between 1959 and 1980. In the fourth section, the main direction of the Brazilian economy between 1959 and 1980 are considered. Finally, in the conclusion the main finding of the paper are summarised

## 2 Structural change and the methodology: the share accounted by each sector in Brazilian real output Erro! Indicador não definido.

Unlike exercises that deal with growth and employment, where the main sources of change were decomposed into their main components, and examined in terms of their absolute growth (annual average growth rate), this paper concerns itself with changes in the relative shares of each sector in output. The model used is known as Deviation model (see Scatolin 1994). The basic aim of this model is to examine deviation from balanced growth in a historical perspective. In a hypothetical balanced growth, all sectors grow at the same rate, equal to the growth rate of the total output growth of the economy. In this hypothetical situation there are no structural changes, with the sectors maintaining the same share in the total output. The aim of the model is to measure the *deviation* from balanced growth.

Defining ● 0 as the ratio of output of the comparative year ($X_2 0$) to that of the base year ($X_1 0$) and, defining:

$\delta X = X_2 - \lambda X_{1\,0}$ 　　　**Erro! Indicador não definido.**

Which
measures the deviation between the comparative-year
production and the balanced growth production. Balanced
growth production $X_{BG\,0}$ is defined as:

**Erro! Indicador não definido.** $X_{BG} = \lambda X = ( I - \hat{u}A )^{-1} \bullet ( \hat{u}\lambda F + \lambda E )$

This equation shows that, because of the linearity of
the input-output model and because of its constant
structural coefficients, if all the elements of domestic
final demand and exports grew at the same rate, gross output
would also increase at the same rate in all sectors and the
output composition would not change (OECD 1992:116).
Then, as in the case of the decomposition of the
sources of growth, the deviation from balanced growth in
output can be decomposed into:

$$\delta X = R_2\hat{u}_2{}^f\delta F + R_2\delta E + R_2\Delta\hat{u}^f\delta D_1 + R_2\Delta\hat{u}^w\delta W_1 + R_2\hat{u}_2{}^w\Delta A\lambda X_1$$

The deviation from proportional growth in output in sector i becomes the sum of five sets of structural
change. Total output change in sector i can be decomposed
into its sources by category of demand as:

$\delta Xi = \Sigma_j r_{ij2}\hat{u}_j{}^f{}_2\,\delta F_0$ = Domestic demand expansion (DD)

$+ \Sigma_j r_{ij2}\delta E_j 0$ = Export expansion (EE)

$+ \Sigma_j r_{ij2}\Delta u_j{}^f\lambda F_{j1}\,0$ = Import substitution of final goods ($is^f 0$)

$+ \Sigma_j r_{ij2}\Delta u_j{}^w\lambda W_{j1}\,0$ = Import substitution of intermediate goods ($is^w 0$)

$+ \Sigma_j r_{ij2}\Delta u_j{}^w\lambda W_{j1}0$ = changes in input output coefficients (IO)


**3 Structural change in the brazilian economy: Main results**


The introduction of new blocks of industries together
with new investments in infrastructure from the 1950s
onwards, promoted a real **structural change** in the Brazilian
economy with positive repercussions on the Brazilian
structure of the economy.

Tables 1 (1959-1980) and 2 (1970-1980) show the results of the deviation decomposition analysis for the main sectors that gained or lost share during these two decades of strong structural change in the Brazilian economy. The results are presented as percentages of the change in the total output, with the last column summarising the separate factors for each sector.

At sectoral level, primary and light industry were the only groups to lose shares in the output during the 1960s and 1970s. Heavy industry and nontradable whose shares increase by 20.61 appropriated all this loss. This result also confirms that the growth of heavy industry was the main force responsible for the structural change in the Brazilian economy during this period. Within heavy industry, the main "slices" were appropriated firstly, by chemical (6.5%), secondly, by transport (4.9%), and thirdly, by electrical (3.4%). The contribution of the nontradable sector was insignificant for the changes, appropriating only 0.65 points.

Table 1: Main Sources of deviation of Brazilian economy,
1959-1980, as Proportion of Total Output Growth

| Sectors | Sources of Change | | | | Real gross output share change (% points) |
|---|---|---|---|---|---|
| | EE | DD | IS | IO | |
| PRIMARY | | | | | |
| 1 Agriculture | -1.06 | -13.75 | 2.00 | 2.93 | -9.88 |
| 2 Mining | 0.24 | -0.12 | -0.11 | 0.31 | 0.32 |
| LIGHT INDUSTRY | | | | | |
| 3 Wood products | 0.15 | -0.22 | 0.04 | -0.40 | -0.43 |
| 4 Paper & pulp | 0.22 | -0.54 | 0.15 | 0.05 | -0.12 |
| 5 Printing | 0.03 | -0.59 | 0.07 | 0.54 | 0.06 |
| 6 Leather | -0.03 | -0.30 | 0.09 | 0.11 | -0.12 |
| 7 Textiles | 0.23 | -5.85 | 0.10 | 1.57 | -3.95 |
| 8 Clothes & foot. | 0.05 | -1.00 | 0.00 | 0.00 | -0.94 |
| 9 Food,bev. tob. | -1.68 | -9.28 | 2.76 | 2.62 | -5.57 |
| 10 Other indust. | 0.05 | -0.49 | 0.09 | 0.39 | 0.03 |
| HEAVY INDUSTRY | | | | | |
| 11 Non metal | 0.14 | -0.11 | -0.16 | 0.44 | 0.30 |
| 12 Metal prod. | 1.08 | -0.95 | 1.92 | -0.32 | 1.73 |
| 13 Machinery | 0.22 | -1.23 | 0.83 | 1.15 | 0.97 |
| 14 Electrical | 0.56 | 0.86 | 0.37 | 1.66 | 3.45 |
| 15 Transport | 1.29 | -0.10 | 1.23 | 2.54 | 4.96 |
| 16 Rubber | 0.18 | -1.10 | 0.02 | 1.78 | 0.87 |
| 17 Chemicals | 0.27 | -1.94 | 2.40 | 5.78 | 6.51 |
| 18 Pharmaceutical | 0.05 | -0.08 | 0.05 | 0.63 | 0.65 |
| 19 Plastics | 0.03 | -0.31 | 0.04 | 0.75 | 0.50 |
| NONTRADABLE | | | | | |
| 20 Electricity | 0.03 | -0.20 | 0.09 | 0.48 | 0.40 |
| 21 Public utilit. | 0.03 | 0.36 | 0.04 | -0.24 | 0.18 |

| | | | | | |
|---|---|---|---|---|---|
| 22 Construction | 0.06 | 1.54 | 0.03 | 0.20 | 1.82 |
| 23 Trade,transport | 0.02 | -3.81 | 1.31 | 1.22 | -1.26 |
| 24 Services | 0.27 | -3.38 | 0.40 | 2.22 | -0.50 |
| Total | 2.44 | -42.59 | 13.72 | 26.43 | 0.00 |
| Primary | -0.82 | -13.87 | -1.89 | 3.24 | -9.56 |
| Light | -0.97 | -18.27 | 3.30 | 4.89 | -11.05 |
| Heavy | 3.82 | -4.95 | 6.67 | 14.41 | 19.95 |
| Nontradable | 0.40 | -5.50 | 1.87 | 3.88 | 0.66 |

Source: 1959 and 1980 Brazilian Input-output tables.
Notes: Decomposition of changes in real output share.
Average of Laspeyres and Paasche indexes.
EE = export expansion.
DD = domestic demand expansion.
IS = import substitution.
IO = technical coefficients.


The main source of the decrease in the share of the primary sector was the final domestic demand (-13.87%). This result was possibly due to the low income elasticity of demand for agricultural and food products. The same pattern was observed in Kubo's (1984) analysis of eight semi-industrial and industrialized economies[25] with every economy presenting a relative decline in the primary sector. The agriculture and food industry also lost shares in the export sector because of the diversification of Brazilian exports.

Changes in the input-output coefficient and in import substitution were the main sources of the structural change in the total economy, the two other factors playing a minor role. Increasing internal linkages among the main sectors seem to explain these changes.

The next table (2) shows only the last phase of structural change, i.e the decade of the 1970s. In this decade, the structural change showed less "imbalance" than occurred in the overall period from 1959 to 1980. The light industries and agriculture continued to lose their share, but not only to heavy industry, but also to the nontradable sector, mainly to construction sector, and to a lesser extent to services.

Within light industry, only food, beverage, tobacco and textiles sectors significantly decreased their shares in the period. In contrast wood, leather, printing and others increased their shares slightly. Within heavy industry, transport, chemical, electrical and machinery again were the main sectors to increase their share in the decade.

The average annual output growth measure and the relative share measure complement each other describing the **extent** of Brazilian structural change. Moreover, these

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[25]Korea, Taiwan, Japan, Turkey, Mexico, Colombia, Israel and Norway.

measures provide important information about the **direction** taken by Brazilian industrialization since the mid-1950s.

Table 2: Main Sources of deviation of Brazilian economy, 1959-1980, as Proportion of Total Output Growth

| Sectors | Sources of Change | | | | | Real gross output share change (% points) |
|---|---|---|---|---|---|---|
| | EE | DD | ISf | ISw | IO | |
| PRIMARY | | | | | | |
| 1 Agriculture | -0.86 | -3.97 | 0.18 | -0.40 | -0.39 | -5.44 |
| 2 Mining | 0.12 | -0.01 | -0.08 | -0.80 | 0.59 | -0.18 |
| | | | | | | |
| LIGHT INDUSTRY | | | | | | |
| 3 Wood | -0.13 | -0.07 | 0.03 | -0.03 | 0.43 | 0.24 |
| 4 Paper | 0.21 | -0.26 | 0.02 | 0.09 | -0.34 | -0.28 |
| 5 Printing | 0.04 | 0.18 | 0.01 | -0.02 | -0.12 | 0.09 |
| 6 Textiles | -0.38 | -3.78 | 0.04 | -0.02 | 2.41 | -1.73 |
| 7 Clothes | 0.10 | -0.81 | 0.01 | 0.00 | 0.02 | -0.67 |
| 8 Leather | 0.00 | -0.17 | 0.01 | -0.01 | 0.21 | 0.04 |
| 9 Food,bev, | -0.67 | -6.75 | 0.00 | -0.06 | 2.22 | -5.26 |
| 10 Other | 0.33 | -0.19 | 0.33 | -0.08 | -0.16 | 0.24 |
| | | | | | | |
| HEAVY INDUSTRY | | | | | | |
| 11 Non-metal | 0.07 | -0.03 | 0.03 | 0.01 | 0.25 | 0.33 |
| 12 Metal | 0.71 | -1.74 | 0.60 | 0.40 | 0.56 | 0.53 |
| 13 Machinery | 0.28 | -1.33 | 0.74 | 0.06 | 1.62 | 1.37 |
| 14 Electrical | 0.44 | 0.38 | 0.50 | -0.28 | 0.43 | 1.48 |
| 15 Transport | 1.30 | -1.07 | 0.22 | -0.27 | 2.14 | 2.32 |
| 16 Rubber | 0.12 | -0.55 | 0.03 | -0.04 | 0.65 | 0.22 |
| 17 Chemicals | 0.19 | -1.26 | 0.75 | 0.19 | 1.46 | 1.33 |
| 18 Pharmaceut. | 0.03 | -0.60 | 0.01 | 0.04 | 0.17 | -0.35 |
| 19 Plastics | 0.07 | -0.35 | 0.04 | -0.03 | 0.97 | 0.70 |
| | | | | | | |
| NONTRADABLE | | | | | | |
| 20 Electricity | 0.06 | -0.59 | 0.05 | -0.03 | 1.63 | 1.11 |
| 21 Public util. | 0.00 | 0.02 | 0.00 | 0.00 | 0.10 | 0.12 |
| 22 Construct. | 0.12 | 0.37 | 0.01 | -0.02 | 2.65 | 3.14 |
| 23 Trade tran. | -0.98 | 13.66 | -0.03 | -0.51 | 1.35 | -0.86 |
| 24 Services | 0.27 | 6.14 | -0.08 | -0.28 | -4.52 | 1.53 |
| | | | | | | |
| Total | 3.40 | -19.08 | 3.47 | -2.13 | 14.34 | 0.00 |
| | | | | | | |
| Primary | -0.74 | -3.98 | 0.10 | -1.20 | 0.20 | -5.62 |
| Light | -0.48 | -11.85 | 0.51 | -0.19 | 4.68 | -7.34 |
| Heavy | 3.20 | -6.54 | 2.92 | 0.09 | 8.25 | 7.92 |
| Nontradable | 1.43 | 3.29 | -0.06 | -0.83 | 1.22 | 5.04 |

Source: 1970 and 1980 Brazilian Input-output tables.
Note: Decomposition of annual average growth rates of Laspeyres and Paasche indexes.
Average annual growth rate computed as 1/n (ln X2/X1).
EE = export expansion.
DD = domestic demand expansion.
ISf = import substitution of final goods.
ISw = import substitution of intermediate goods.
IO = technical coefficients.

# 4 The *direction* taken by the Structural change in the Brazilian economy

It is generally accepted (OECD 1992:13) that positive structural change in an industrialized economy, corresponds to expansion in national sectors of the economy whose counterparts in the main industrial economies are also expanding, and similarly to contraction in sectors that are also declining in the main industrial world. In late industrialization the direction of the changes are not very different, i.e. the introduction of the main blocks of industries, which constitute the basic framework of the modern industrial economy, such as machinery, electrical equipment and chemicals. Moreover, a successful strategy of late industrialization such as South Korea (Amsdem 1989, and Hewit 1992) tries to reduce her technological gap by investing not only in the old sectors already developed in the industrial economies, but also investing in new emergent sectors such as micro-electronics or biotechnology.

Normally two measures can be used to assess the direction of these structural changes: technological intensity and output growth. This section examines firstly the direction as measured by the technological-intensity criterion and secondly the direction taken by Brazilian output-growth with respect to the agro-industrial system.

As regards the technological-intensity criterion, firstly it is necessary to examine which industries produce innovation in an industrial economy. Perroux[26] has suggested that the core of innovation in the industrial economies is produced basically by two groups of industries: **new industries** based on nuclear power, electronics, and certain aspects of plastics and chemicals; and **modern industries** "those that constitute the basic framework of the modern production device - iron and steel, metal manufactures, engineering, electrical equipment, motorcars and aircraft" (Perroux 1988:68). The biotechnology industry can undoubtly be included in the first list (new industries).

Pavitt (1984) examined the sectoral patterns and trends in the production and use of 4,378 innovations in the UK from 1945 to 1983. The main results of his research (table 4.11) show that a few *cores* of sectors - *chemical, mechanical, machinery, instruments and electronics*, accounted for 64 percent of all UK innovations, and a further six, a "secondary" sectors - *metals, electrical engineering, shipbuilding / offshore engineering, vehicles,*

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[26]See chapter 1 section 1.4.

*building materials and rubber and plastic* - accounted for almost 23 percent.

Together, these two groups (11 sectors) produced 87 percent of the all post-War UK innovations. The results also show that basically the technology used by the agricultural sector was produced more by other sectors than by the sector itself, in a relation of 1 to 8.

Sherer (1982) not only carried out a similar research for the USA, but also constructed a sectoral technological input-output matrix (production and use), based on patented inventions of more than 440 large USA companies in 1974, and the USA 1974 input-output table. Despite the well-known structural differences between the UK and the USA economies, Sherer's results were similar to Pavitt with the same two main groups of industries producing 86.7 percent of the all innovations. More importantly for this thesis, Sherer identified the main flow of technical change in the agricultural sector.

Table 3: Pavitt taxonomy of production and use of innovation by industry in the UK 1945-83.

| Sectors | No of innovation produced | No of innovation Used |
|---|---|---|
| **Primary** | | |
| Agriculture | 15 | 121 |
| Mining | 18 | 279 |
| **Light** | | |
| Food & drink & tobacco | 82 | 105 |
| Textile, leather & clothing | 146 | 481 |
| Paper | 40 | 65 |
| Printing | 15 | 104 |
| **Heavy** | | |
| Chemicals | 413 | 167 |
| Ferrous and non ferrous metal | 189 | 190 |
| Machinery | 910 | 81 |
| Mechanical | 331 | 327 |
| Instruments | 546 | 120 |
| Electrical/electronics | 793 | 383 |
| Shipbuilding and offshore engineering | 137 | 112 |
| Vehicles | 226 | 263 |
| Aerospace | 141 | 175 |
| **Diverse** | | |
| Bricks, pottery, glass & cement | 148 | 105 |
| Timber, rubber, plastic other goods | 122 | 57 |
| **Nontradable** | | |
| Construction | 43 | 189 |
| Utilities | 22 | 103 |
| Transport | 2 | 137 |
| Business | 17 | 116 |

| | | |
|---|---|---|
| R&D | 3 | 128 |
| Other services | 5 | 63 |
| Health care | 4 | 187 |
| Defence | 0 | 124 |
| Other government service | 9 | 69 |
| Final consumers | 0 | 126 |
| **Total** | **4378** | **4378** |
| Primary | 33 | 400 |
| Light | 283 | 755 |
| Heavy | 3687 | 1819 |
| Nontradable | 105 | 1242 |
| diverse | 270 | 162 |

Source: Based on Robson, Townsend and Pavitt 1988.

From a total of US$561.8O million spent on research and development (R&D), US$128.1 million originated within the agricultural sector, with the other main suppliers being the chemical industry (agricultural chemicals supplying US$142.8 million) the transport industry (motor vehicles and equipment supplying US$78 million) and the pharmaceutical industry (supplying US$32 million).The modern agro-industrial system depends heavily on the innovations coming from the chemical, transport and machinery sectors. The range of inputs supplied by the chemical industry varies from specialized inputs to agriculture, such as fertilizers, plant-protection products and pharmaceutical products to other specialized inputs to the different food and fibre-processing industries, such as additives, preservatives, sweeteners, flavourings, artificial fibres. From the transport and machinery sectors the range of inputs varies from farm machinery to specific machine tools for agri-industry (Lemos 1992).

Nevertheless, as Sherer's research shows, an important part of the innovations activities of the agricultural sector came from within the sector. The specificity of agricultural production made the production of biological innovations a necessity in the own sector, historically by the government research. As suggested by Goodman (1989) and Kloppenburg (1990) the biological production/consumption cycle of agricultural production created unique problems for industrial *appropriation*. Seed is the core of crop production and the most important agricultural input. The introduction of hybrid corn in the 1930s is one of the best examples of the technological improvements within agriculture. The core of the Green Revolution was linked with the improvements derived from the new varieties of rice and wheat developed by the International agricultural research centres.

On the base of the R&D expenditure of 11 industrialized economies, OECD (1992) divided the manufacturing sector into three levels of technology

intensity growth: High, medium and low. This division, despite suffering the limitation of being based only on one indicator-R&D expenditure and of excluding the agricultural and service sectors, complements the evidence of Pavitt and Scherer and gives a general picture of the technological intensity of the different industries in the industrialized economies.

Table 4: The Technology intensity groups within the manufacturing industry- Main industrialized countries.

| **Erro! Indicador não definido.**High technology | Medium Technology | Low technology |
|---|---|---|
| Aerospace, Computers and office machinery Communication and semiconductor, Pharmaceuticals, Instruments, Electrical machinery, | Motor vehicles, Chemicals, Other manuf. Non electrical machinery, Rubber & plastics, Non-ferrous Other transportation equip. | Stone, clay & glass Food & drink & tobacco, Shipbuilding, Petroleum refining, Ferrous metals, Fab. metals products, Paper & printing, Wood, cork & furniture, Textiles, footwear & leather |

Note: Listed in descending order of R & D intensity.

Source: OECD (1992:17).

In fact, the observation made by Perroux on the growing inducing industries are in line with the evidence of Pavitt, Sherer and OECD. Light industry - food, drink and tobacco, textiles, footwear, leather, paper and printing, wood, furniture - and the agricultural sector are among the less dynamic technological industries, using more technology than they produce. The core of sectors which induces technical change in a modern industrial economy can be found within the heavy industry, in particular the machinery, transport, chemical, mechanical and in the new industries such as micro-electronics (computers, communication and semiconductor) part of plastics, chemicals, and biotechnology.

Two digit aggregation of the Brazilian 1959 input-output table did not permit the separation of the respective individual industries considered by OECD as high and medium technology industries, from each others. Nevertheless, if the industries in question are considered at the two-digit level, examination of the results of tables 4.11 and 4.12 shows that the second phase of Brazilian industrialization from the mid-50s to the mid-80s proceed in the direction of the technology intensive groups (medium and high groups), mainly in the direction of the sectors termed by Perroux as modern industry. Some new industries (Aerospace, computers, communications, pharmaceutical, instruments and machinery)

at **least** were introduced into the country. Aerospace, telecommunications, and computers sectors obtained a clear industrial policy support in the 1970s, with some positive results. However other new industries (mainly the micro-electronic industry) did not receive the same attention from the policy-makers. The general approach from the mid-50s, was one of the technological *laissez-faire*. This type of economic policy led to the main technology-intensive sectors being developed by multinational firms without a strong commitment of the development to an endogenous technological capability. Private Brazilian firms did not involve themselves in strong R&D sectors preferring investments in more traditional sectors.

Together with the development of important upstream industrial sectors such as chemical, transport, and machinery, the Brazilian agro-industrial system was stimulated by the creation of a strong and articulated farm research system in 1973 through the creation of the parastatal Brazilian Agricultural Research Enterprise (Embrapa). This company coordinated the works of 44 different research organizations and a wide range of national, regional or commodity specific agricultural extension institutions. This system has been doing important research and diffusion of new technologies in plants and soils, with new high-yilding varieties of seeds being released, and virgin infertile soils being incorporated into cultivated areas.

In relation to the second goal - the direction taken by Brazilian industrialization in respect to the agro-industrial system - the two measures discussed in the previous sections can be used: the absolute growth rate and the relative share. The figure belows show the direction of the structural change in Brazilian economy, as measured by the absolute output growth from 1959 to 1970 and to 1980, of the different sectors of the economy.

From a long rum perspective (1959-1980) the direction taken by Brazilian late industrialization was clearly towards the electrical, transport, machinery, plastics and chemicals sectors. The dynamism of the economy moved towards these sectors. In 1959 these sectors alone accounted for by 42.6 percent of the industrial investment, and in 1980 remained responsible for 33.89 percent (IBGE 1990). In the 1970s the process was less imbalanced with the difference of growth between the sectors being less intensive.

Agriculture and light industries were among the less dynamic sectors of the economy in the whole period, growing only by 4.8 percent, less than the national average in this period. This situation could perhaps lead to the conclusion that the agro-industrial system was not important in terms of growth in the second stage of Brazilian industrialization, i.e. they were declining activities.

Nevertheless these sectors are closely integrated, both by inter-sector connections and by final demand linkages, with the new blocks of heavy industries introduced in the country since the 1950s.

The transport and machinery sectors along with the chemical industry as discussed previously, are the most important suppliers of the modern agro-industrial system, and were among the most important sectors responsible for the Brazilian overall growth in this period. Table 5 shows the increasing participation of intermediate consumption in the total value of agricultural production.

Table 5: Brazilian Agriculture-Intermediate consumption as percentage of the total value of production, 1959-1980.

|  | 1959 | 1970 | 1980 |
|---|---|---|---|
| AGRICULTURE | 7.3 | 12.5 | 13.5 |
| MAIN UPSTREAM SECTORS | 4.2 | 9.5 | 16.1 |
| metal | 1.1 | 0.2 | 0.4 |
| transport | 0.1 | 0.2 | 0.1 |
| chemical | 2.6 | 5.5 | 9.0 |
| pharmaceutical | 0.1 | 1.1 | 0.3 |
| animal feed | 0.3 | 2.5 | 6.3 |
|  |  |  |  |
| OTHER SECTORS | 3.2 | 1.8 | 9.2 |
| electric energy | 0.0 | 0.2 | 0.3 |
| fuel | 0.2 | 0.6 | 2.7 |
| others | 3.0 | 1.0 | 6.2 |
|  |  |  |  |
| TOTAL-INTERMEDIATE | 14.7 | 23.8 | 38.8 |
| IMPORTED |  | 0.5 | 0.2 |

Source: Brazilian Input-output tables.

From a meagre 14.7 percent in 1959, the participation of intermediate consumption increased to 38.8 percent in 1980. This indicator (intermediate consumption) shows the increased dependence of agriculture on industrial inputs. Increasingly the industrial sector *appropriated* parts of the agricultural production process. The upstream agriculture sectors with its forward linkages with agriculture, provided the basic source of transformation of Brazilian agricultural sector. However this process was not an homogeneous process. In fact only 25 percent of Brazilian rural properties could be considered as modern in 1980. This sector was responsible for 75 percent of the total output of Brazilian agriculture in 1980. The remaining 75 percent of the rural properties were basing their production basically in land and labour force.

Although the per capita income of Brazil was considerably lower than that of the industrialized economies, the pattern of income distribution and demand prevailing in the Brazilian economy favoured the growth of some of the same sectors which were growing fast in the industrialized world; the intermediate and consumer durable industries. Nevertheless, the results show that the process of structural change in Brazilian economy by 1980 did not follow exactly the same direction as was taken by the structural change in the main industrialized countries. In these countries the main direction taken was towards the services sector and the high-technological industries. Until 1980 the direction taken by Brazilian changes was towards the heavy industry, but not towards the most dynamic industries such as the micro-electronics.

According to the second measure examined – the relative share – the direction of the Brazilian structural change was towards the diversification of the industrial structure i.e. away from agriculture and light industry, but not very far from the Brazilian agro-industrial system. Agriculture and the light industries were, as already suggested, the only sectors which lost share within the economy in this period. These two sectors lost 20.93 percent points between 1959 and 1980. In the face of this movement, light industry and agriculture decreased their shares in the total output, that of agriculture decreasing from 16.57 percent in 1959 to 7.64 in 1980, and that of light industry from 23.57 percent in 1959 to 16.06 in 1980. On the other hand, heavy industry increased its share in the total manufacturing output from 47.52 percent in 1959 to 60.59 percent in 1980 (IBGE 1990). The diversification of Brazilian exports is another indicator of the direction taken by the changes in the Brazilian economy. Table 6 shows the evolution of Brazilian exports from 1959 to 1980.

Table 6:  Shares accounted by each sector in the total
          exports, 1959-1980, (in percentages)

| Sectors | 1959 | 1970 | 1980 |
|---|---|---|---|
| *Primary* | | | |
| Agriculture | 10.04 | 9.07 | 2.91 |
| Mining | 2.13 | 4.11 | 8.06 |
| *Light* | | | |
| Wood & Furniture | 0.06 | 3.62 | 1.55 |
| Paper and Print. | 0.06 | 0.33 | 2.29 |
| Textiles | 0.76 | 7.27 | 3.32 |
| Clothing,foot.leather | 1.71 | 1.35 | 2.63 |
| Food & bev. & tob | 51.68 | 40.55 | 27.06 |
| Other industries | 0.05 | 1.48 | 1.63 |
| *Heavy* | | | |
| Non-metallic | 0.17 | 0.37 | 0.62 |
| Metal products | 0.01 | 4.37 | 6.05 |
| Machinery | 0.12 | 2.25 | 4.49 |
| Electrical equip. | 0.01 | 0.72 | 3.84 |

| | | | |
|---|---|---|---|
| Transport equip. | 0.07 | 0.67 | 7.77 |
| Rubber | 0.03 | 0.16 | 0.51 |
| Chemicals | 5.38 | 1.94 | 5.07 |
| Pharmaceutical | 0.05 | 0.22 | 0.34 |
| Plastics | 0.00 | 0.01 | 0.26 |
| *Non-tradable* | | | |
| Public utilities | 0.00 | 0.00 | 0.00 |
| Construction | 0.00 | 0.00 | 0.82 |
| Trade & transport | 27.66 | 21.51 | 19.05 |
| Services | 0.00 | 0.00 | 1.75 |
| Total | 100 | 100 | 100 |

Source: Brazilian Input output tables.

The exports which in the mid-50s were based mainly on agriculture and food industries (mainly coffee) diversified within the agro-industrial system such as soyameal, and towards other sectors such as transport and machinery. In 1980 agriculture and light industry contributed only 41.4 percent of the total exports as compared to 64.4 percent in 1959. The Brazilian case has some similarities with Linder's (1961) case of **representative demand**, where comparative advantage is acquired through production for domestic demand. The learning process involved in the Brazilian late industrialization without a strong commitment with export targets, took some time before the sector was able to compete in international market.

## 5 Main Conclusions

The development of the decomposition technique provides economic historians with an strong tool for analyzing, from the demand side, the main sources of structural change that took place in Brazilian economy and in other countries in the last few decades.

The Brazilian economy grew rapidly from the 1950s to the beginning of the 1980s. The two most important groups of industries that constitute the core of a modern industrial economy were introduced into Brazil during this period, and contributed positively to the overall economic growth.

Despite output growth being more intense in the 1970s the pattern observed suggests firstly, an increasing importance of domestic final demand followed by export expansion as the dominant sources of change, and secondly, a decreasing importance of import substitution and of the input-output coefficient for change. The diversification of the basket of consumption associated with Engels' law partly explains the increasing importance of the domestic final demand during the period. In the food, drink and tobacco sector, exports alone contributed almost 25 percent of the overall growth. The Brazilian economy, which specialized in agricultural exports until the 1950s, diversified its exports in the following decades, with all industries

contributing to the export growth. Input-output coefficients represented another important source of growth for the Brazilian economy during this period as a result of increased intermediate linkages among the heavy and other industries. The increasing connection between agriculture and its upstream industries was confirmed by the positive contribution of technical change to the growth of the agricultural sector between 1959 and 1980.

A significant shift in the share of real output in favour of heavy industry took place in the Brazilian economy during this period. Within heavy industry, the chemical, transport, plastics and electrical sectors gained the largest share. Agriculture and light industry were among the less dynamic sectors of the economy, loosing shares during these two decades of profound structural change. Despite the direction of the structural change being towards heavy industry, the Brazilian agro-industrial system also benefited from this direction as a result of the backward linkages with the chemical, transport, machinery, and pharmaceutical industries.

Finally, the main sources of growth of employment were outside the agriculture sector mainly towards the industrial and to the nontradable sector. More than 18 million jobs were created in the industrial and nontradable sectors between 1959 and 1980. Whereas the main source of output growth was heavy industry, the main source of employment growth was the nontradable sector (14.7 millions of new jobs). Domestic final demand was the main source of employment growth in both periods, increasing in the 1970s. Input-output changes in the 1970s and labour productivity in the period with more intensively in the 1970s decrease the amount of working population in the economy.

The Brazilian economic policy and in particular the industrial and trade policies of the the 1950s and also of the post-64 were an important variable in explaining the economic growth and different performances within the main sectors of the economy, despite the decomposition I-O model did not alow to conclude the causal-effect relation.

This is particularly true of the industrial policies of the Kubitschek (1955-60) and Geisel (1975-79) governments. An ambitious economic plan executed by the Kubitschek government (Target Plan) tried to overcome the main bottleneck of the economy through import substitution policies, with the aim of stimulating the domestic market. Another economic plan (II National Development plan) of the Geisel government in the mid-70s also implemented an import-substitution strategy combined with increasing export incentives in order to overcome the international oil crisis through investments in intermediate goods such as fertilizers, petrochemicals, paper, non-ferrous metal etc.

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